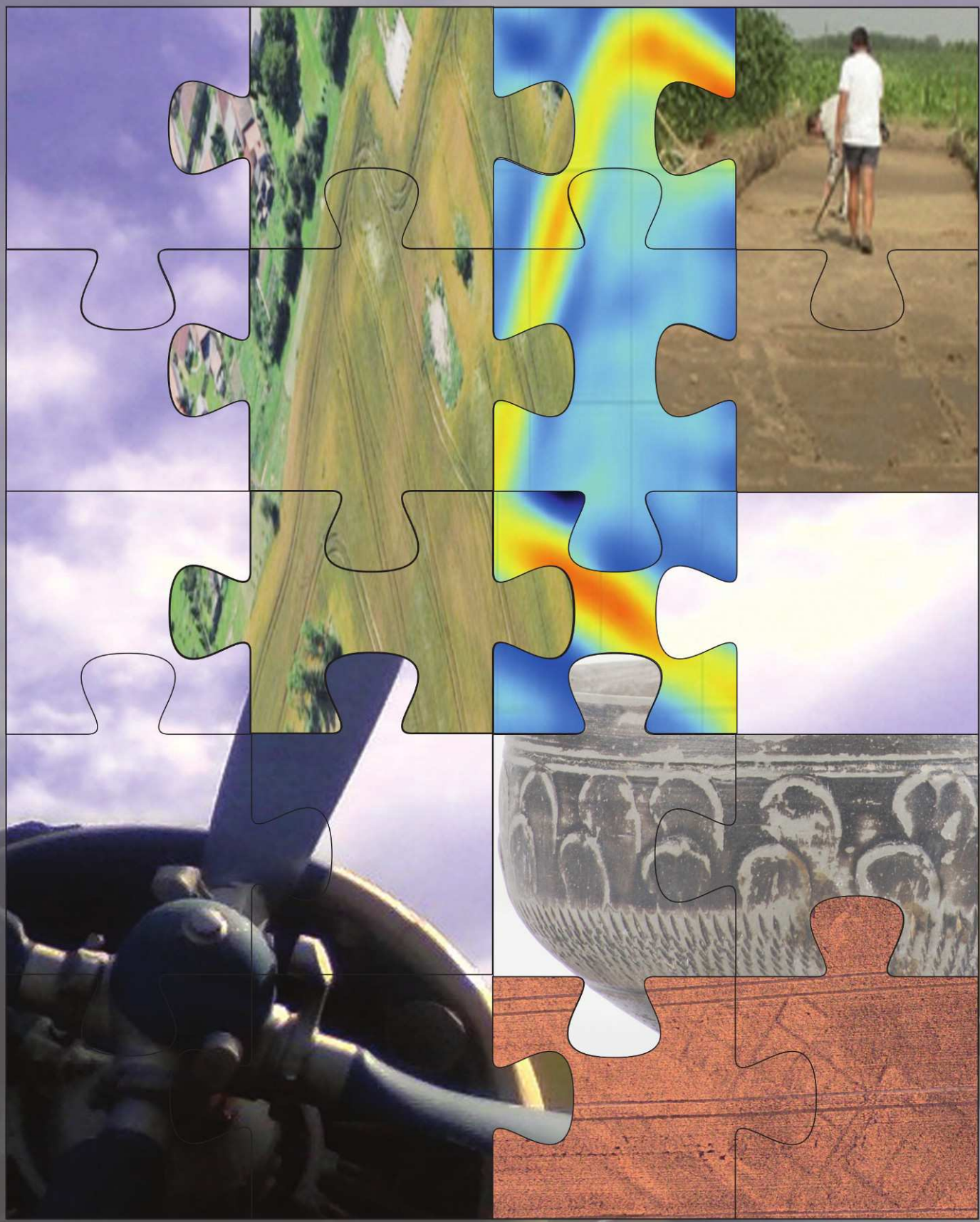

# Aerial Archaeology and Remote Sensing from the Baltic to the Adriatic

Edited by Zoltán Czajlik and András Bödőcs

Institute of Archaeological Sciences, Eötvös Loránd University

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# Borders. The problems of the aerial archaeological reserach of a Roman *limitatio* in Pannonia

András Bödőcs

Keywords: centuriatio, limitatio, cadastral system, Roman road, aerial archaeology, Savaria, Pannonia, GIS, predictive model

During the past five years, we had the opportunity to build up a research method series in order to prove and verify the Roman land allocation system in the broader area of Szombathely (County Vas, western Hungary), the oldest continuously populated town of Hungary. These methods are derived from the "classical" landscape archaeology package: the combination of GIS modelling, aerial archaeological reconnaissance, field survey and geophysical prospection. The focus of our investigations more recently was the extent of the Roman cadastral system (called *limitatio*) and its impact on the landscape.

## Introduction

With the support of the Hungarian Scientific Research Fund (OTKA), the Zoltán Magyary Fellowship and, more recently, of the János Bolyai Research Scholarship of the Hungarian Academy of Sciences, a structured research project was initiated for new studies in this field, a rather neglected area in Hungarian archaeological research.

The project is essentially based on a model presented earlier in the form of a PhD dissertation (Bödőcs 2008) and of a MSc thesis (Bödőcs 2009), in which I proposed a new basic grid reconstruction of the ancient cadastral system of the Roman colony of Savaria (Szombathely). Following the GIS-based analysis of Roman roads in 2008, an interesting relationship was noted between some ancient road sections; the post-processing of their coordinate values led to the calculation and reconstruction of a theoretical grid. This reconstructed grid layout was employed to detect possible vestiges of the Roman cadastral system on various, already accessible aerial and satellite images, e.g. it was adapted to Google Earth. During the detailed examination of these aerial and satellite images, new potential sites were registered in 2009, which were treated as preliminary results. The new data thus gained enable the fine-tuning of the theoretical reconstruction model and our pilot project was to test the model in the field through aerial archaeological investigation.

The grants mentioned in the above permitted a series of targeted aerial archaeological flights along this virtual grid. We spent over thirty hours above the study area in western Hungary. The reconnaissance was carried out by Zoltán Czajlik, whose expertise ensured the project's initial success already in 2010, despite the nowhere near ideal weather conditions for aerial archaeological reconnaissance. We also had the opportunity to conduct a brief archaeological field survey and geophysical prospection to test our model for further research.

## The research objective

The project's goal was to study the so-called *limitatio* (or *centuriatio*) of the Roman colony of Savaria. Savaria had been established in the mid-1st century AD, during the reign of the Emperor Claudius (Mócsy 1974). While the many still unresolved problems surrounding the foundation of the settlement is not the subject of this paper, the land allotment is directly connected to our research project. One of the many questions is how and why had the colony been founded at the time when the province of Pannonia was still in the phase of formation.

There is epigraphic evidence that the veterans of the *legio XV Apollinaris* had been settled in this region (RIU 1, 185; RIU 1, 146; RIU 1, 145; RIU 1, 194; RIU 1, 213; RIU 1, 32; RIU 1,149) and that the surrounding area was divided and allotted among them. Accordingly, research on the *centuriatio* plays an important role in the reconstruction of the town's first period, as well as of the province's early history. In 1965, András Mócsy proposed a hypothetical reconstruction of the

town's street system (Mócsy 1965) based on surviving traces of the road and the hydrological network, as well as on the forest borders that had the same or a perpendicular alignment. Endre Tóth based his reconstruction of the entire assumed territory of Savaria on more or less the same evidence (Tóth 1977a). Despite the attractiveness of their theoretical reconstruction, the lack of adequate archaeological data means that many uncertainties remain regarding the exact line of the colony's boundaries and how and which regions were pacified by the Roman settlers (fig. 1).

The development-led excavations on the former territory of the colony during the past decade have brought to light Roman road sections (Ilon 2001, Redő 2006, Mátyás 2007). These sections can be interpreted as part of the *centuriatio*, even though they have a different size and orientation than previously reconstructed (Bödőcs 2009). Based on this new theoretical reconstruction model, we began a topographical project to determine the finer details, the boundary and the extent of the Roman land plot system and of the territory of Savaria.

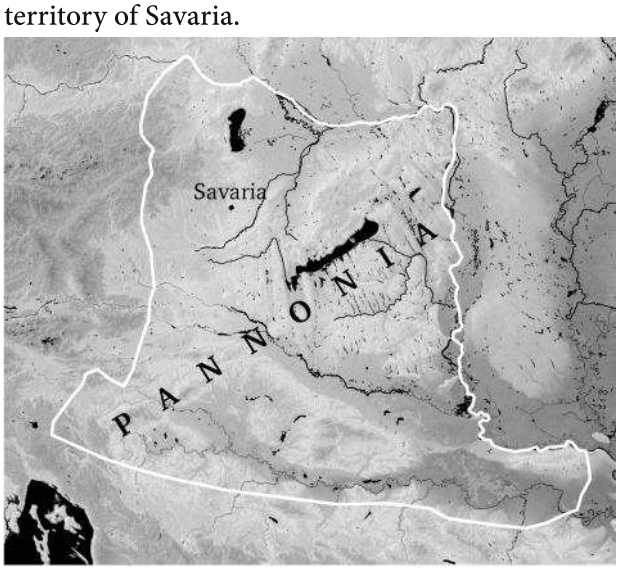


Fig. 1. Location of *colonia Claudia Savariensis*

## Aerial archaeological examples

First, we tried to gather evidence that would confirm our hypothesis of *centuriatio*, and thus we had to search for and document the surviving remains of gravel roads, ditches (channels) and visible boundaries on the available material such as archive oblique and vertical aerial photos, Google Earth images, etc. With help of a some kind of "black lines"-tools created in GIS environments (in various projections and file formats), we were able to identify cropmarks and soilmarks that had a very convincing correspondence with our model, fitting into it like the pieces of a huge jigsaw puzzle.

1. Vasasszonyfa (HUN)

Soilmarks enabled the identification of a wide road or ditch (channel) junction in the location where it was assumed to be in the predictive model on images taken from Google Earth dating from 2003. The form, the size and the alignment of this feature leaves no doubt that it can be identified as the boundary of a *centuria* unit of the Roman land plot system (fig. 2).

2. Bildein (A)

The Google Earth images were also helpful in identifying a visible cropmark feature on the satellite images lying immediately beyond the current Hungarian border. This rectangular linear feature is similarly consistent with the model regarding its size and orientation (fig. 3).

## Aerial archaeological reconnaissance

Following our successful search for possible traces on earlier vertical photos, we organised short test flights arranged along our grid model. The theoretical "grid corner" coordinates were used as guide points during the prospection and the targeted areas were the ones where there was a promising concentration of road or ditch-like features identified from the preliminary examination of maps and photos. To ensure positive results, we first flew over the broader area of the one-time colony because the land in that area was certain to have been centuriated as indicated by the excavated Roman gravel road sections mentioned above.

1. Vép (HUN)

A Roman road leading eastward from Savaria crosses the area in question. This road is well known from Endre Tóth's research (Tóth 1977b). Unfortunately, no cropmarks were visible during the flight; however, the line of this road can be traced clearly on the Google Earth map and other archive photos. The road could be interpreted as the east-west main axis of the Roman land use

Fig. 2. Vasasszonyfa-Tüskés. *Centuria* border (source: Google Earth)

Fig. 3. Bildein (A). *Centuria* border (source: Google Earth)

system, the so-called *decumanus maximus* (Bödőcs 2009; Bödőcs–Kovács 2011; Czajlik *et al.* 2012b). Despite the absence of any visible traces of the road, other features of interest could be identified in the target area. One of these was a north to south aligned linear feature crossing the fields that could be interpreted as the border-road (*limes*) of the Roman cadastral system based on our model. Other parallel features visible in the area perhaps indicate the inner divisions of a *centuria* (fig. 4).

2. Rum (HUN)

In the summer of 2010, the rainy weather was not too favourable for aerial survey, but this year, we had the opportunity to test the correctness of the model in the field. We were able to identify the double ditches of a Roman road from cropmarks

Fig. 4. Vép. (photo: Zoltán Czajlik, 28.06. 2010)

in the south-eastern part of the colony's assumed territory (fig. 5). The size, the location and the orientation conformed to the expectations, the documented Roman road was of the same type as the excavated parallels. The distance between the two road ditches was ca. 5.4–6 m, conforming to the width of the known Roman gravel roads unearthed near the colony (Ilon 2001; Mátyás 2007).

Because the aerial reconnaissance had yielded very interesting results, the investigation was expanded to include the possible boundary of the colony's one-time territory. The potential region was searched for remains that would fit the predictive model. It is still too early to link the (road)marks documented in this region to the Roman land plot system, but the planned, detailed topographical survey will hopefully verify an association between the two.

The most interesting locations in these regions lie in the eastern and north-eastern boundary zone of the colony's assumed *territorium*.

3. Külsővat (HUN)

There are many visible features indicated by cropmarks and soilmarks that correspond to the orientation and location of our reconstructed grid on the outskirts of Külsővat. This zone is located along the River Marcal, east of the River Rába, where many sites from the Roman Age have been documented (MRT 4, Site No. 4/40). These include a few dating from the turn of 1st–2nd centuries AD (MRT 4, Site No. 4/6, 4/10; Vida 1996). The presented aerial archaeological site photographed in 2010 is a potential road junction on the *centuria* border, indicated by light linear cropmarks. There were no similar linear features of this type on the photos known until 2012; however, the images published on Google Earth in 2012 from this area contained some parallel and right-angled linear soilmarks, including our previously photographed location. The preliminary photogrammetrical measuring revealed that the distance between these lines is roughly 240 Roman feet (*pedes*), i.e. 2 *actus* and all of them correspond to the hypothetical model (fig. 6).

## Field survey

Parallel to the aerial reconnaissance, we also wanted to test the feasibility of the model in the field and thus we conducted control field surveys in the areas where Roman land allotment can be taken for certain. An approximately 50–100 m wide buffer zone was checked along the hypothet-

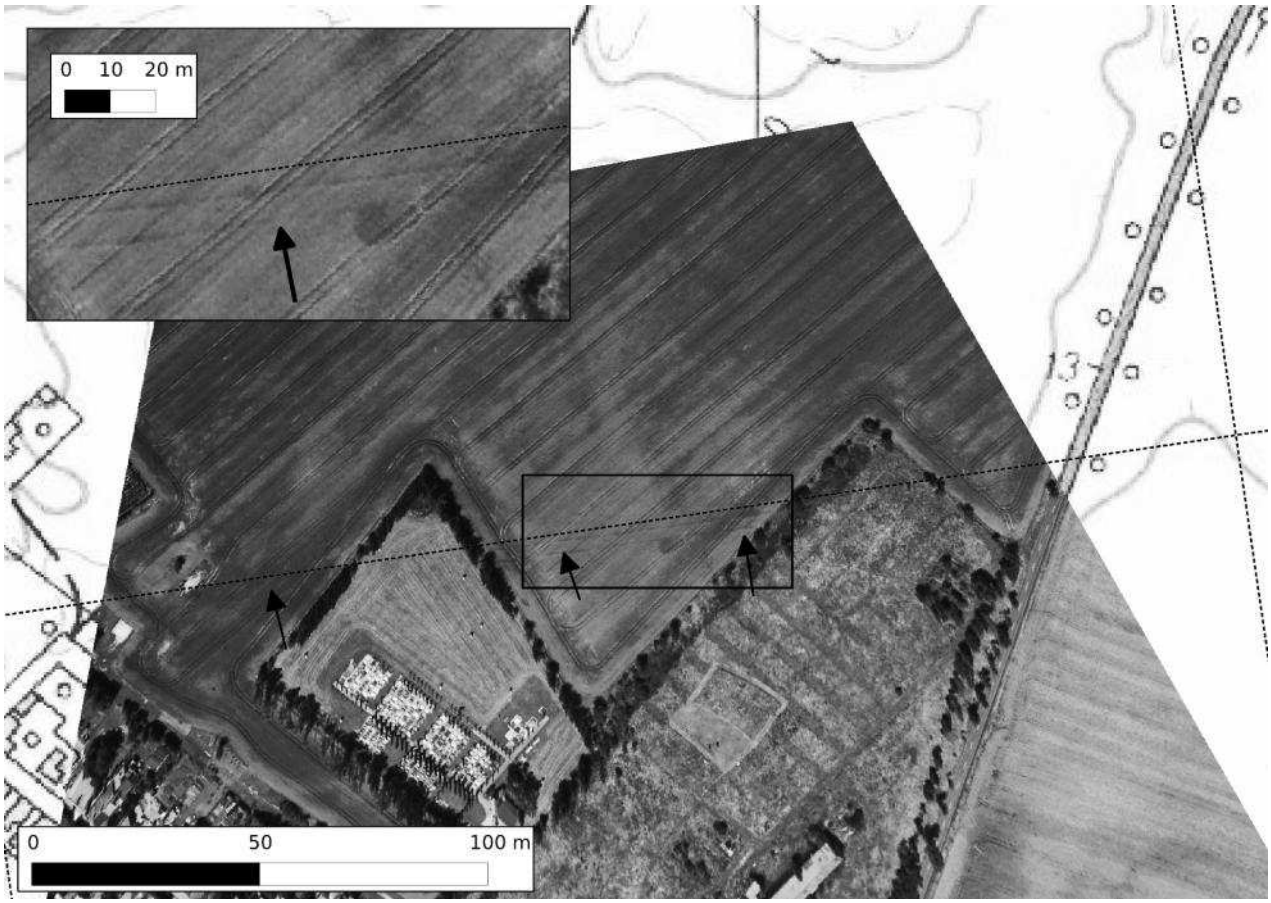


Fig. 5. Rum (photo: Zoltán Czajlik, 28.06. 2010)

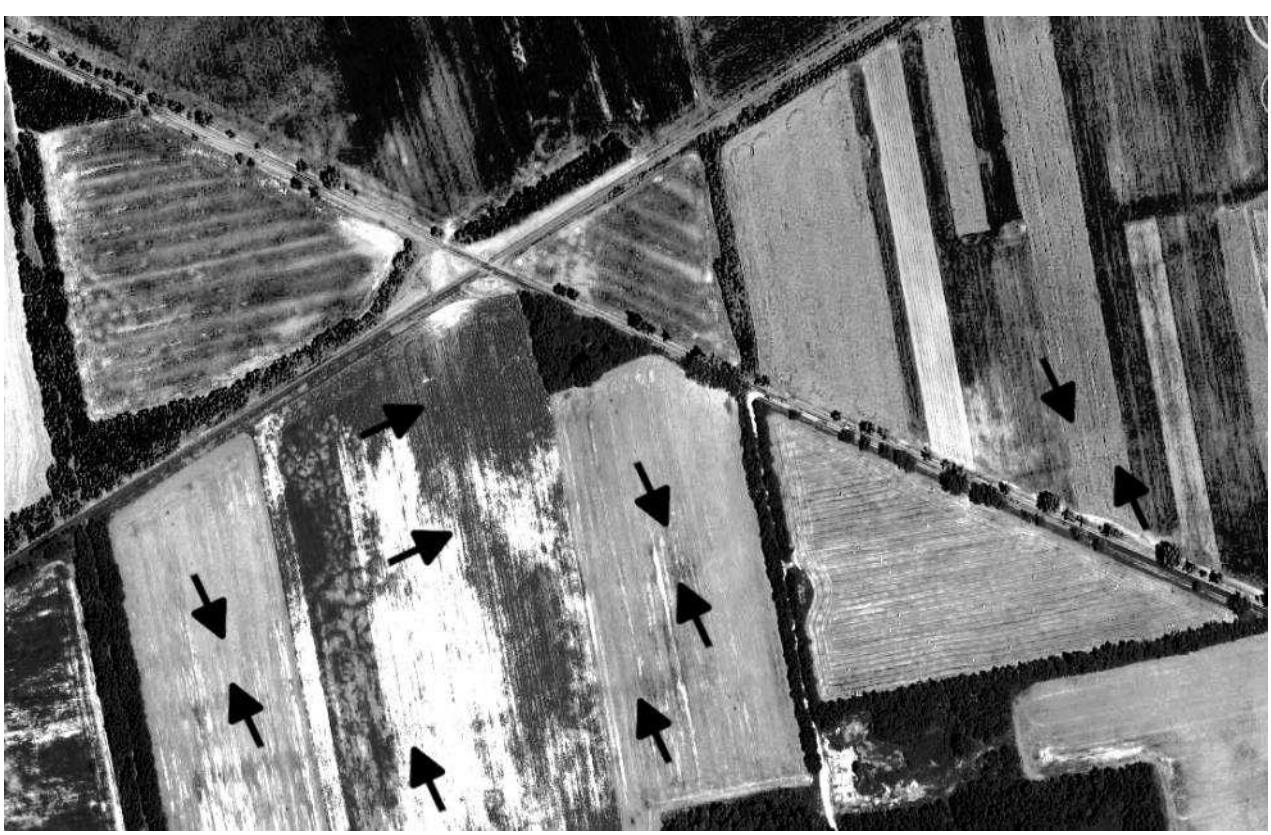

Fig. 6. Külsővat (photo: Zoltán Czajlik, 28.06. 2010)

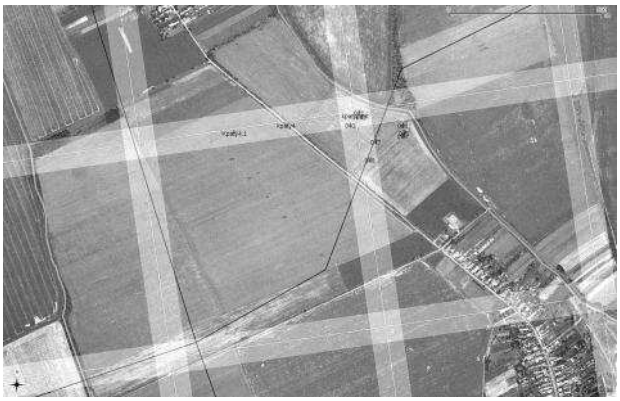

Fig. 7. Buffer zones of the field walkings (source: Google Earth)

ical grid lines, along the one-time ancient boundary roads. The basic concept was the assumed existence of Roman sites along the lines in the buffer zone yielding material from the Roman Age, from the turn of the 1st and 2nd centuries AD. This concept was based on the excavation findings of the past decade, namely the discovery of Roman graves and settlement remains near the identified road sections (Ilon 2001, Bíró 2006, Mátyás 2006). In our case, positive results and the identification of sites would confirm the association with the *centuriatio* grid (fig. 7).

We encountered several problems during the field survey, some practical, some theoretical. Firstly, we only had one season for testing our model and even though the field surveys were scheduled for the ideal periods (in Hungary, for example, the best time is after most crops have been harvested). The archaeological identification of the farm-like sites turned out to be the most relevant methodical issue because smaller Roman farms, smaller *villa*s and residential buildings are usually indicated by poor surface finds only. The one-time sporadic existence of individual farms across a wider area is one of the reasons, others being that the use-life of these buildings was rarely more than a few decades and that they were usually wooden buildings that were rarely rebuilt in stone. Very often, sites have disappeared owing to deep ploughing. We nonetheless managed to identify a handful of previously unknown sites using this method, all of which lay close to our hypothetical grid border as shown by the following few examples.

1. Vasasszonyfa (HUN)

At Vasasszonyfa, we discovered two separate sites on both sides of the assumed road junction. The

Fig. 8. Roman ceramics from Vasasszonyfa (photo: A. Bödőcs)

*imbrices* indicate a settlement, while the ceramics with perforated base and the various vessel types rather suggest a small destroyed cemetery. In both cases, the distance from the assumed boundary was no more 10–15 m. In addition to the Roman artefacts, we also found a Copper Age arrowhead without any other prehistoric material (fig. 8).

2. Felsőcsatár 1 (HUN)

We found traces of a small Roman settlement near Felsőcsatár near the Austrian border, west of the former colony. Similarly to the above-described site, we assumed that there was an intersection of the theoretically reconstructed *centuria* boundaries. An ancient road, usually assumed to have Roman origins, runs near the site and there are Roman sites along it. Although the remains of the so-called "katanzki put", the “soldier's road” (VMFN 34/127; Bödőcs 2008) could be identified in this location, it seems more likely that the Roman sites known from the area can be linked to the land allotment system rather than to the road of uncertain date (fig. 9).

3. Felsőcsatár 2 (HUN)

A few hundred meters west of Site 2, we found a small scatter of Roman ceramics in the field survey's buffer zone. This site was indicated only by these finds; more importantly, however, it has a very interesting location, as will be discussed below.

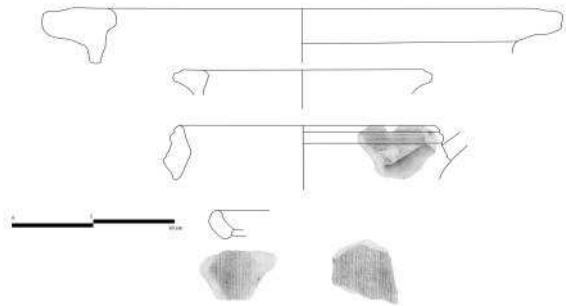

Fig. 9. Roman ceramics from Felsőcsatár (drawing: B. Simon)

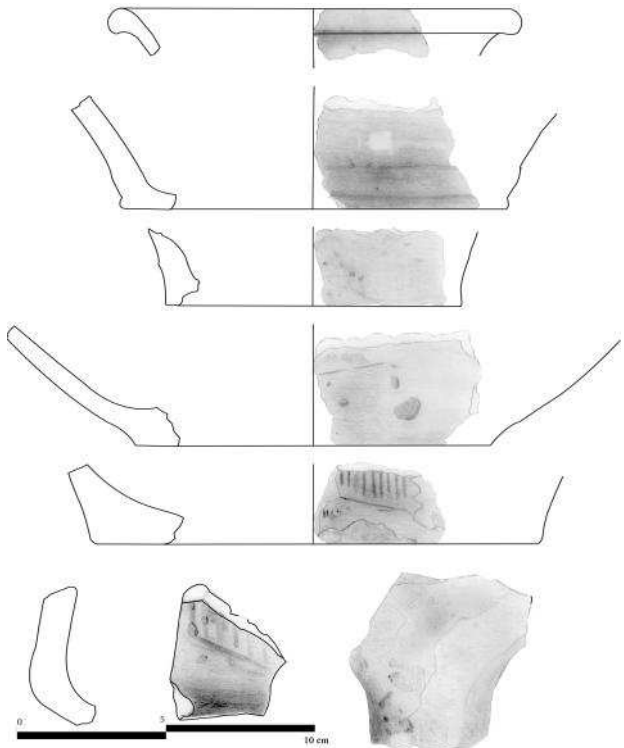

Fig. 10. Roman ceramics from Rum (drawing: B. Simon)

4. Rum (HUN)

Remains of the above-described Roman road could not be identified in the kohlrabi fields and neither were there any finds 2–300 m to the east; however, the remains of a smaller Roman settlement were identified along this road in the field survey's zone. The bank of the River Rába was densely populated in the Roman Age, as shown by the archaeological sites recorded during previous field surveys (based on the official site register of the National Office of Cultural Heritage (KÖH) No. 43239-40, 42651, 42656, 42681-83, 64226, 64228, 64232). The visible remains of the *centuriatio* confirm the existence of the subdivision in this region and they also indicate that Savaria's *territorium* extended at least as far as the River Rába (fig. 10).

It was noted earlier that even though the model does not always correspond to the features in the field, the control points based on excavation data verify its goodness. The regions where the field surveys were conducted were checked again on vertical aerial photos from different sources not used previously. Following the post-processing and

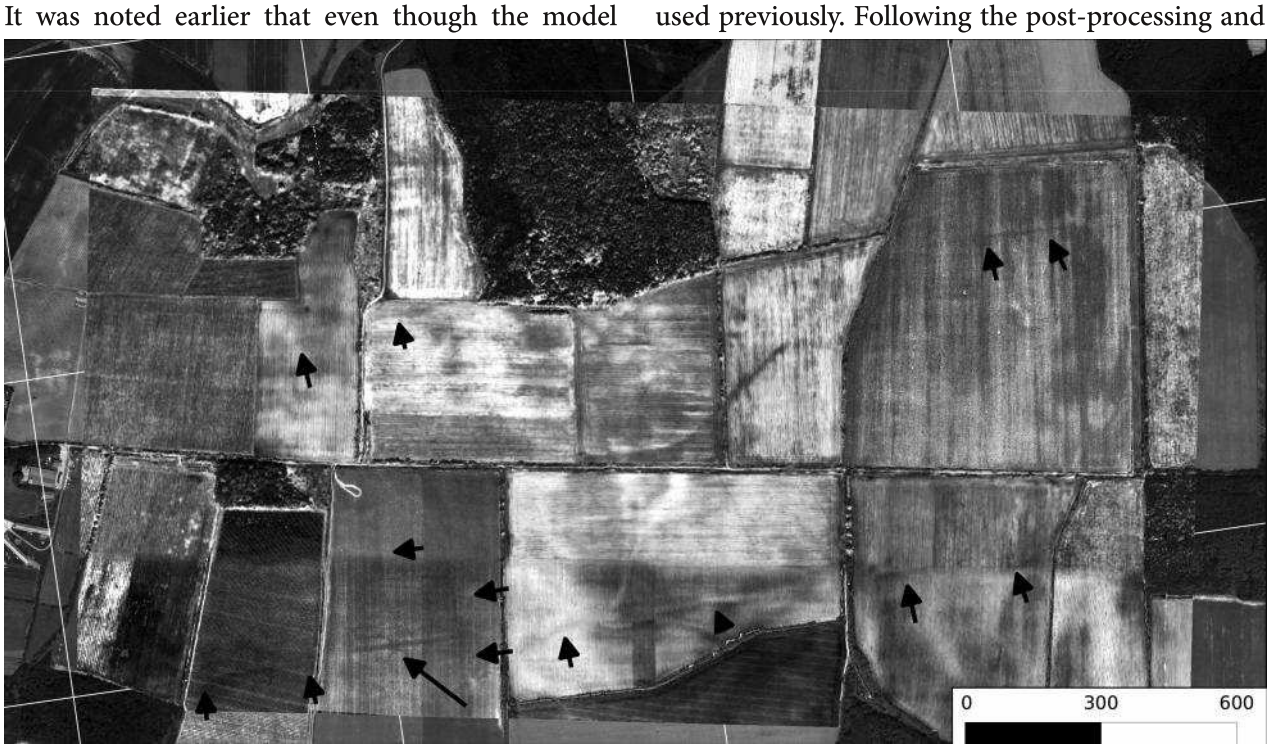


Fig 11. Felsőcsatár. Visible traces of the *limites* (border roads) of the *centuriatio.* Photomosaic (Google Earth, Archive of IAS, ELTE) with the vector model of the *centuriatio* (white lines)

the filtering of the images, other details of the possible remnants of Roman field boundaries could be identified. A roughly 2 km long field boundary road with multiple road junctions can be seen on the image mosaic (fig. 11.): it seems likely that it can be identified as the Roman road leading westward from Savaria and because this road section is located more or less in line with the Roman road between Savaria and Bassiana – a straight line connecting them can be draw between the two – it can probably be interpreted as the western section of the east-west main axis (*decumanus maximus*). The road junctions could be interpreted as marking the inner divisions of the *centuria* units. It also became clear that the main parameters of the theoretical reconstruction of the *centuriatio*'s grid was reliable, although there were some deviations from the "ideal" construction already in Roman times, which can probably be explained by the non-identical ancient land plot sizes (fig. 11).

## Geophysical prospection

In 1999, a geophysical survey was conducted at Zanat near Szombathely, where a Roman road junction was excavated by Gábor Ilon (Ilon 2001). This geophysical prospection was carried out by Sándor Puszta. The smaller ditches of a Roman gravel road were identified. The results clearly outline the small and shallow ditches of the road. Because of the difficulties in identifying gravel roads in the field, we performed a short geophysical investigation in order to determine whether there was a *centuriatio* on the eastern bank of the River Rába; however, it remains uncertain whether the cadastral system had been actually laid out in this region.

The geophysical prospection was carried out by an Overhauser magnetometer under the superintendence of Sándor Puszta in the area of the assumed grid nodes. The test area was chosen based on the presence of several features with the "right" orientation and the presence of *tumuli* indicated by circular soilmarks that had been identified earlier on archive photos and on Google Earth maps. Two ca. 2500 $m^2$ large areas were selected near the River Rába, where Roman sites have already been found during earlier topographical field surveys conducted by the specialists working in the County Vas Museum.

Despite prior negotiations with the field's owner, the conditions were not suitable for prospection: for example, one of the areas had been deep ploughed. The results from this area showed nothing but the direction of the ploughed furrows. Neither did our other test region near Sárvár produce any obvious results: the post-processing of the data, however, indicated trench-like phenomena running parallel to the lines of the theoretical grid, but there were no convincing sign of the roads visible. Unfortunately, this field was heavily disturbed owing to road constructions in the modern times.

Thus, even after the prospection, the question remains open of whether or not the Roman *centuriatio* existed east of the River Rába.

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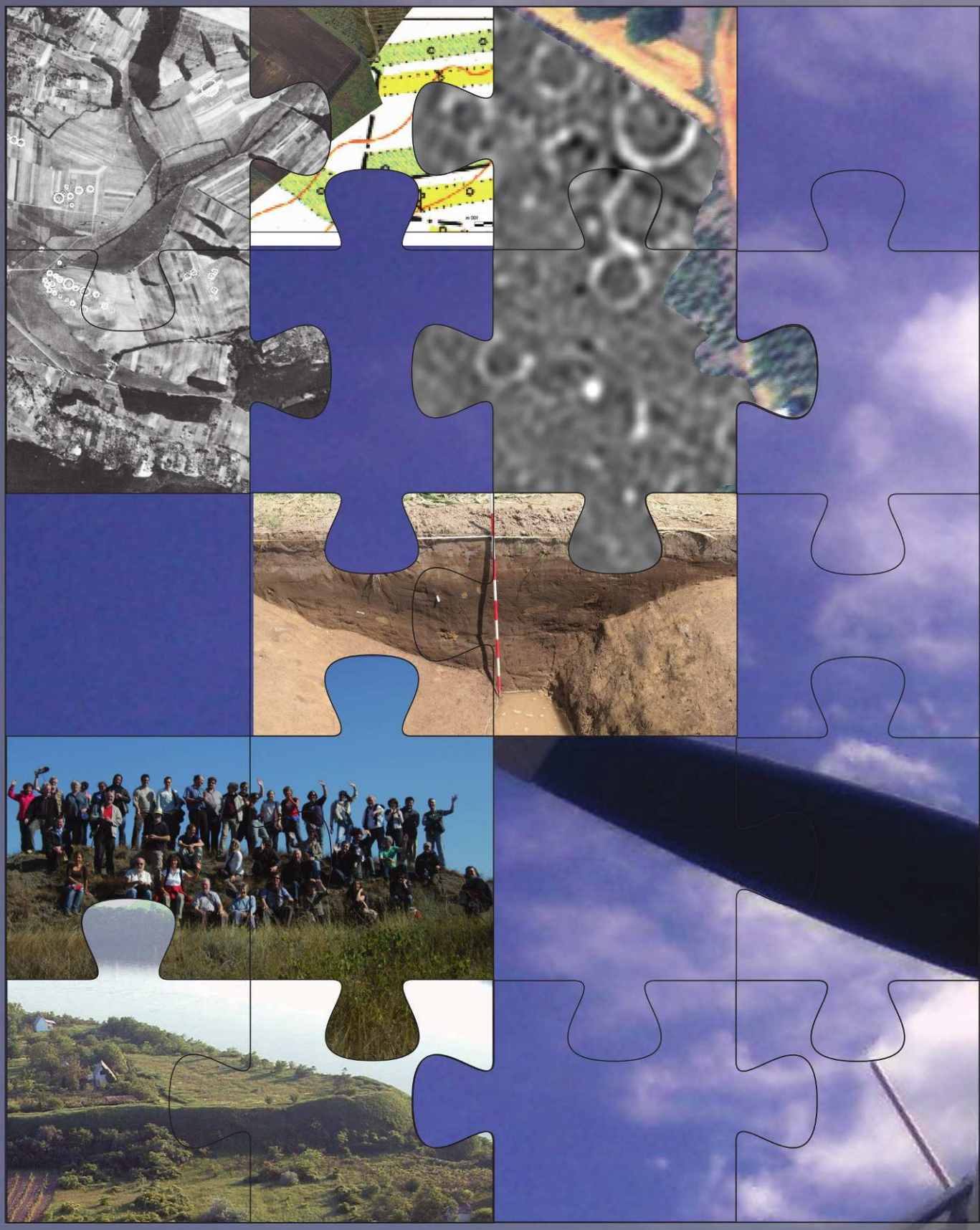

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